U.S.ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
540 S. MORRIS AVE., MONTGOMERY, AL 36115
ALPBET ANALYSES

REPORT OF SAMPLE DELIVERY GROUP #1200016

Project:	Dimock Residential GW Site, Dimock, PA - Follow-up work
Analysis method:	Gross Alpha and Beta on Water Samples
Report ID:	1200016-ALPBET
Report type:	Original
Date reported:	06/13/2012
Total pages in report:	16

SAMPLES

NAREL Sample #	Client Sample ID	Location	Matrix	Date Collected	Date Received
B2.05495G	FB22	PA:DIMOCK	WATER-DRINKING	05/22/2012	05/23/2012
B2.05496H	HW64	PA:DIMOCK	WATER-DRINKING	05/22/2012	05/23/2012
B2.05497J	FB23	PA:DIMOCK	WATER-DRINKING	05/23/2012	05/24/2012
B2.05498K	HW63Z	PA:DIMOCK	WATER-DRINKING	05/23/2012	05/24/2012
B2.05499L	HW62	PA:DIMOCK	WATER-DRINKING	05/22/2012	05/24/2012
B2.05500K	HW63	PA:DIMOCK	WATER-DRINKING	05/23/2012	05/24/2012

EXCEPTIONS

1. **Packaging and shipping** – No problems were observed.
2. **Documentation** – No problems were observed.
3. **Sample preparation** – No problems were encountered.
4. **Analysis** – No problems were encountered.
5. **Holding times** – No holding times were specified.

QUALITY CONTROL

1. **QC samples** – All QC analysis results met NAREL acceptance criteria.
2. **Instruments** – Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.

CERTIFICATION

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Director of the Center for Environmental Radioanalytical Laboratory Science and the NAREL Quality Assurance Manager, or their designees, as verified by the following signatures.

Mary Wisdom 6-18-12

Mary F. Wisdom — Date
Quality Assurance Manager, NAREL

Cynthia White 6-14-12

Cynthia A. White — Date
Acting Director, Center for Environmental Radioanalytical Laboratory Science

GENERAL INFORMATION

SAMPLE TYPES

BLD	Blind sample
FBK	Field blank
SAM	Normal sample

ANALYSIS QC TYPES

ANA	Normal analysis
DUP	Laboratory duplicate
LCS	Laboratory control sample (blank spike)
MS	Matrix spike
MSD	Matrix spike duplicate
RBK	Method blank
STD	External standard (used for ^{228}Ra yield determination)

QUALITY INDICATORS

RPD	Relative Percent Difference
%R	Percent Recovery
Z	Number of standard deviations by which a QC measurement differs from the expected value

RADIOCHEMICAL DATA

Radiochemical analyses usually require the subtraction of an instrument background measurement result from a gross sample measurement result. Both values are positive, but when the sample activity is low, random variations in the two measurements can cause the gross value to be less than the background, resulting in a measured activity less than zero. Although negative activities have no physical significance, they do have statistical importance, as for example in the evaluation of trends or the comparison of two groups of samples.

To the extent practical, it is the policy of NAREL to report results as generated, whether positive, negative, or zero, together with the "2-sigma" measurement uncertainty and a sample-specific estimate of the minimum detectable concentration (MDC). The measurement result, uncertainty, and MDC are always expressed in the same unit of measurement.

EVALUATION OF QC ANALYSES

A method blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "*Z* scores." A *Z* score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The *Z* score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The *Z* score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the *Z* score is computed.

Each standard uncertainty used to compute a *Z* score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of method blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

GENERAL INFORMATION (CONTINUED)

GROSS ALPHA AND BETA ANALYSIS

In comparison to the methods employed to determine radionuclide-specific activities, the method used by NAREL to determine gross alpha and beta activities has the potential for greater analytical uncertainty. Although NAREL attempts to estimate the total uncertainty of each result, the analytical method does not admit a rigorous uncertainty analysis. Significant components of the uncertainty must be based on professional judgment and historical data. For this reason results from gross alpha and beta analyses should be used only as gross approximations of the alpha and beta activity present.

Note that NAREL does not automatically qualify individual results from gross alpha/beta measurements, although the values may be significantly overestimated or underestimated in relation to the reported uncertainty.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY

SDG #1200016

ANALYSIS SUMMARY

Analysis method: NAREL GR-01
Title: Gross Alpha and Beta on Water Samples

NAREL Sample #	Client Sample ID	QC Type	Date Completed	Preparation Batch #	Assay Batch #
B2.05495G	FB22		06/07/2012	0008805G	0016024Q
B2.05496H	HW64		06/07/2012	0008805G	0016024Q
B2.05497J	FB23		06/07/2012	0008805G	0016024Q
B2.05498K	HW63Z		06/07/2012	0008805G	0016024Q
B2.05499L	HW62		06/07/2012	0008805G	0016024Q
B2.05499L	HW62	DUP	06/07/2012	0008805G	0016024Q
B2.05499L	HW62	MS	06/07/2012	0008805G	0016024Q
B2.05500K	HW63		06/07/2012	0008805G	0016024Q
LCS-00639807D *		LCS	06/07/2012	0008805G	0016024Q
RBK-00639808E *		RBK	06/07/2012	0008805G	0016024Q

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

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SDG #1200016

SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05495G	Amount analyzed:	2.500e-01 L
Client sample ID:	FB22	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-22 11:58 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 16:16	100.0	GQ2A	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	2.64e-01	1.0e+00	9.1e-01	PCI/L	06/07/2012 16:16 CDT
Beta	1.63e-01	1.0e+00	1.6e+00	PCI/L	06/07/2012 16:16 CDT

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SDG #1200016

SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05496H	Amount analyzed:	2.500e-01 L
Client sample ID:	HW64	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-22 11:10 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 16:16	100.0	GQ2B	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	3.25e-01	1.3e+00	1.1e+00	PCI/L	06/07/2012 16:16 CDT
Beta	9.75e-01	1.2e+00	1.8e+00	PCI/L	06/07/2012 16:16 CDT

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SDG #1200016

SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05497J	Amount analyzed:	2.500e-01 L
Client sample ID:	FB23	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-23 13:25 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 16:16	100.0	GQ2C	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	3.43e-01	1.0e+00	9.1e-01	PCI/L	06/07/2012 16:16 CDT
Beta	6.37e-01	1.1e+00	1.7e+00	PCI/L	06/07/2012 16:16 CDT

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SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05498K	Amount analyzed:	2.500e-01 L
Client sample ID:	HW63Z	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-23 13:10 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 16:16	100.0	GQ2D	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	6.66e-01	1.6e+00	1.3e+00	PCI/L	06/07/2012 16:16 CDT
Beta	1.97e+00	1.4e+00	2.1e+00	PCI/L	06/07/2012 16:16 CDT

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SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05499L	Amount analyzed:	1.000e-01 L
Client sample ID:	HW62	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-22 15:59 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 17:56	100.0	GQ2A	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	3.04e-01	3.1e+00	2.9e+00	PCI/L	06/07/2012 17:56 CDT
Beta	3.76e-01	2.6e+00	4.0e+00	PCI/L	06/07/2012 17:56 CDT

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SDG #1200016

SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05499L	Amount analyzed:	1.000e-01 L
Client sample ID:	HW62	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-22 15:59 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	DUP
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 17:56	100.0	GQ2B	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	-5.26e-01	2.9e+00	2.7e+00	PCI/L	06/07/2012 17:56 CDT
Beta	2.38e+00	3.0e+00	4.5e+00	PCI/L	06/07/2012 17:56 CDT

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SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05499L	Amount analyzed:	1.000e-01 L
Client sample ID:	HW62	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-22 15:59 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	MS
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 17:56	100.0	GQ2C	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	1.80e+02	3.9e+01	3.0e+00	PCI/L	06/07/2012 17:56 CDT
Beta	1.53e+02	1.9e+01	1.1e+01	PCI/L	06/07/2012 17:56 CDT

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SAMPLE ANALYSIS REPORT

Lab sample #:	B2.05500K	Amount analyzed:	2.500e-01 L
Client sample ID:	HW63	Preparation batch #:	0008805G
Matrix:	WATER-DRINKING	Assay batch #:	0016024Q
Collected:	2012-05-23 13:09 EDT	Prep procedure:	N/A
Sample type:	SAM	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 17:56	100.0	GQ2D	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	8.26e-01	1.7e+00	1.3e+00	PCI/L	06/07/2012 17:56 CDT
Beta	2.98e+00	1.5e+00	2.1e+00	PCI/L	06/07/2012 17:56 CDT

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SAMPLE ANALYSIS REPORT

Lab sample #:	LCS-00639807D	Amount analyzed:	1.000e+00 SAMP
Client sample ID:	N/A	Preparation batch #:	0008805G
Matrix:	N/A	Assay batch #:	0016024Q
Collected:	N/A	Prep procedure:	N/A
Sample type:	N/A	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	LCS
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 19:36	100.0	GQ2A	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	1.81e+01	3.9e+00	3.2e-01	PCI	06/07/2012 19:36 CDT
Beta	1.44e+01	1.8e+00	1.1e+00	PCI	06/07/2012 19:36 CDT

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SAMPLE ANALYSIS REPORT

Lab sample #:	RBK-00639808E	Amount analyzed:	1.000e+00 SAMP
Client sample ID:	N/A	Preparation batch #:	0008805G
Matrix:	N/A	Assay batch #:	0016024Q
Collected:	N/A	Prep procedure:	N/A
Sample type:	N/A	Analysis method:	NAREL GR-01
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	RBK
Sample description:	N/A		
Comment:	N/A		

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
06/07/2012 19:36	100.0	GQ2B	GVJ

ANALYTICAL RESULTS

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Reference Date
Alpha	1.45e-01	3.5e-01	2.9e-01	PCI	06/07/2012 19:36 CDT
Beta	-1.82e-02	2.8e-01	4.5e-01	PCI	06/07/2012 19:36 CDT

U.S. ENVIRONMENTAL PROTECTION AGENCY
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SDG 1200016

PREPARATION BATCH SUMMARY

Preparation batch #: 0008805G
Analysis method: NAREL GR-01
Preparation procedure: N/A

NAREL Sample #	Client Sample ID	Analysis #	QC Type	Yield	± 2 σ Uncertainty	Analyst
B2.05495G	FB22	00638936H		N/A		CHD
B2.05496H	HW64	00638942F		N/A		CHD
B2.05497J	FB23	00638948M		N/A		CHD
B2.05498K	HW63Z	00638969T		N/A		CHD
B2.05499L	HW62	00638954K		N/A		CHD
B2.05499L	HW62	00639804A	DUP	N/A		CHD
B2.05499L	HW62	00639805B	MS	N/A		CHD
B2.05500K	HW63	00638960H		N/A		CHD
LCS-00639807D *		00639807D	LCS	N/A		CHD
RBK-00639808E *		00639808E	RBK	N/A		CHD

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

QC RESULTS FOR BATCH 0008805G

NAREL Sample #	Analysis #	QC Type	Analyte	%R	RPD	Z	Evaluation
B2.05499L	00639804A	DUP	ALPHA		-749.5	-0.39	PASS
B2.05499L	00639804A	DUP	BETA		145.6	1.03	PASS
LCS-00639807D	00639807D	LCS	ALPHA	104.1		0.36	PASS
LCS-00639807D	00639807D	LCS	BETA	92.8		-1.21	PASS
B2.05499L	00639805B	MS	ALPHA	102.9		0.26	PASS
B2.05499L	00639805B	MS	BETA	98.4		-0.26	PASS
RBK-00639808E	00639808E	RBK	ALPHA				PASS
RBK-00639808E	00639808E	RBK	BETA				PASS